PHISHING ATTACK DETECTION USING MACHINE LEARNING METHOD

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Bachelor of Computer Science
(Computer Systems and Networking) with Honors

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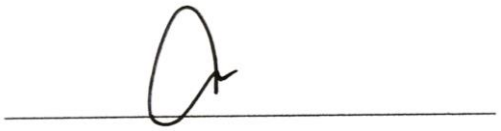
SUPERVISOR'S DECLARATION

I hereby declare that I have checked this thesis, and, in my opinion, this thesis is adequate in terms of scope and quality for the award of Bachelor of Computer Science (Computer System and Networking).



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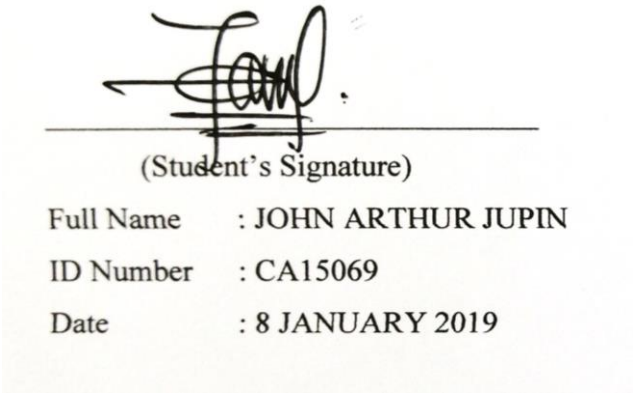

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ABSTRAK

Pembangunan rangkaian komputer pada masa kini adalah sangat pesat. Perkara ini tidak dapat lagi dinafikan kerana setiap pengguna komputer di serata dunia perlu menyambungkan komputer mereka ke rangkaian Internet. Hal ini demikian menunjukkan bahawa penggunaan rangkaian Internet adalah sangat penting, sama ada ianya digunakan untuk tujuan kerja dan tugasan mahupun untuk mengakses ke akaun media sosial, contohnya Instagram, Facebook dan Twitter. Walaubagaimanapun, dalam pengunaan luas rangkaian komputer ini, secara tidak langsung, privasi pengguna komputer adalah dalam bahaya. Hal ini demikian disebabkan pengguna komputer tidak menitikberatkan sistem sekuriti dan keselamatan di dalam komputer mereka. Oleh sebab ini, penggodam akan menggodam dan membuat serangan rangkaian ke atas pengguna komputer dengan mudah. Hal ini demikian sangat bahaya, terutama sekali kepada organisasi penting kerana penggodam dapat melumpuhkan sistem atas talian dalam syarikat, mencuri maklumat-maklumat sulit dan seterusnya mencuri wang syarikat secara atas talian tanpa disedari oleh mana-mana pihak. Antara serangan yang boleh dibuat termasuklah serangan penafian-perkhidmatan, serangan perdayaan dan *phishing*. Matlamat dalam kajian ini ialah untuk menggunakan alat *anti-phishing* dalam menghalang serangan sekuriti rangkaian di dalam satu organisasi. Dalam kajian ini, serangan *phishing* telah dikaji secara mendalam. Selepas kajian dibuat, cara yang telah diutarakan untuk menghalang serangan *phishing* ialah melalui pembelajaran mesin. Selain itu, kajian ini juga menunjukkan bahawa serangan *phishing* selalunya berhubung kait dengan serangan mesej *spam*. Mesej *spam* ini termasuklah email dan juga mesej SMS yang diterima dari pengguna. Dalam pembelajaran mesin, terdapat beberapa algorithma yang boleh digunakan dalam menghalang kedua-dua serangan ini. Algorithma *Naïve Bayes*, algorithma Pokok Keputusan dan algorithma Mesin Vektor Sokongan telah digunakan untuk menghalang serangan *spam*, dan juga serangan *phishing* daripada berlaku. Kajian algorithma ini dibuat secara mendalam dan cara-cara dalam melaksanakan algorithma ini telah dibincangkan secara mendalam dan lebih terpencil. Eksperiment juga telah dijalankan untuk set data yang diperoleh dengan menggunakan kaedah pembelajaran mesin. Keputusan telah diperoleh, di mana menunjukkan prestasi untuk kaedah pembelajaran mesin untuk setiap set data.

ABSTRACT

The development of computer networks today is increased rapidly. This can be shown based on the trend of every computer user around the world, whereby they need to connect their computer to the Internet. This shows that the use of Internet networks is very important, whether they used it for work and assignment purposes, or for the access to social media accounts, such as Instagram, Facebook and Twitter. However, in this wide use of this computer network, the privacy of computer users is in danger. This is because some of the computer users do not install security system in their computer. This problem will allow the hackers to hack and commit the network attacks. This is very dangerous, especially to the important organizations because hackers can disable the online system in the company, steal confidential information and subsequently steal company money through online without being aware of any one. The attacks that can be made includes denial-of-Service attack, DNS spoofing attack and phishing attack. The goal of this study is to apply anti-phishing tools in preventing the network security attack in an organization. In this study, phishing attacks have been studied thoroughly. After a study has been made, machine learning method is used to prevent the phishing attack. Besides, the study also shows that phishing attack is always related to the spam attack, where there might be attached phishing link in the spam message. This spam message includes the email and the SMS message that received by the user. There are several algorithms that can be used in the machine learning method to prevent the both attacks. The Naïve Bayes algorithm, Decision Tree algorithm and Support Vector Machine algorithm has been used to prevent the spam attack, as well as the phishing attack. The study of this algorithm is made thoroughly and the methods in implementing this algorithm have been discussed in detail. The experiment is conducted for the datasets that obtained by using machine learning method. The results are obtained, showing the performance of machine learning method on each dataset.

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LIST OF ABBREVIATIONS

DNS	Domain Name System
URL	Uniform Resource Locator
SVM	Support Vector Machine
ARFF	Attribute Relation File Format

CHAPTER 1

INTRODUCTION

1.1 Background of study

Network security is the most important and critical issues that need to be considered and emphasized in the network, especially in an organization, such as offices, banks and clinics. Basically, network security is the authorization, commonly by using a username and password, which inhibit and monitor the unauthorized access and all the administrator event in the network (Pawar & Anuradha, 2015).

It is important for the organization to maintain their security network to ensure the privacy and confidentiality of their employer data, as well as their employee data. This will ensure the data, especially the sensitive data, such as the employee information details, can be stored in the server safely. For example, for us to access the online banking, we need to have an authentication to access our account. This can be done by providing the username and password in the login page of the online banking. Authentication is needed in this scenario so that our sensitive data would not be exposed to the unauthorized user or the hacker.

Although there is implementation of the network security in an organization, but still there is network attack happened. The network attack that usually happen includes phishing, denial-of-Service attack and Domain Name System (DNS) spoofing. This attack will contribute to the financially and privacy loss to the victims. For example, when the hacker attacks sensitive information while the user using their online banking account, the attacker will use this information to retrieve back the victim's account and then steal their money inside the account. This also can be applied to the office organization, whereby the hacker will gain the sensitive data and use it to commit online crimes, such as stealing the office's money and the data of their employer over the Internet.

Phishing is one of the network security attack, which is the derivational of word 'Fishing' by replacing the 'F' with 'Ph'. Phishing is the act of imitate the genuine websites to collect the sensitive information from the victim and use it for committing crimes, such as illegal financial gain (Kaur & Kaur, 2015). This attack typically starts when the hacker sends an email that seems original to the victim and persuade them to update and verify their information by clicking the Uniform Resource Locator (URL) link in the email (Mohammad, Thabtah, & McCluskey, 2015). Usually, the phishing email will redirect the user to the infected website and asking them to provide their particular information, such as their personal details and bank account information, which will be used to hack the information whatever the user enter (Suganya, 2016). The phishing attack is always related to the spamming email that received by the victim. Those spam emails are also vulnerable to the phishing attack because some of the spam email may contain the link that will redirect the victim to the phishing websites.

The phishing attack can be prevented using the machine learning method. According to Marsland (2015), machine learning is the modification or adaptation of the computer actions so that we can get the more accurate actions in the end. Besides, machine learning is also considered as computational complex since it will lead to produce algorithm. Based on the machine learning method, the prevention of phishing attack can be classified to several algorithm, which includes Decision Tree algorithm, Naïve Bayes algorithm and Support Vector Machine (SVM) algorithm (Smadi, Aslam, Zhang, Alasem, & Hossain, 2016). All the algorithms stated are used in classifying the spam email and the SMS messages datasets. This will show the performance of each of the algorithm, in terms of their accuracy.

1.2 Problem statement

After doing some research, there are some methodologies of overcoming the attack that has been found, which is already exists. Each of them has their own advantages and disadvantages respectively. The summary of the problems is tabulated in the Table 1.1;

Table 1.1: Tabulation of the problem

No.	Problem	Description	Effect
1	Classification of the phishing result is not accurate (Smadi et al., 2016).	The result that obtained after the test, which is the true positive and the false positive does not be considered.	The result that obtained might not be correct and accurate.
2	The level of performance of the method (Smadi et al., 2016).	The performance level of the method does not be considered when the method was used.	The result of the test might take longer time to be obtain.

1.3 Research goal and objective

The goal of this research is to detect phishing attack. The objective of this study is stated as below;

i. To study the issues of phishing attack.
ii. To use machine learning method, which is Naïve Bayes algorithm, Decision Tree algorithm and Support Vector Machine algorithm in detection of phishing attack.
iii. To evaluate the performance of machine learning method in detection of phishing attack.

1.4 Scope of the research

The scope of this research is listed as follow;

i. The research is focus on the method on how to overcome the network security attack, which is machine learning method.
ii. The network security attack will be observed thoroughly.
iii. The dataset that will be use in this algorithm is the email message dataset and SMS message dataset, which contains spam and legitimate (ham) messages.

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